

ATTACHMENT A
Remarks

Claims 1 and 5-44 are pending in the present application with claims 1, 5-29, 37 and 41-44 withdrawn from consideration. Upon entrance of this Amendment, Applicants have amended claims 30 and 32-35. Applicants respectfully submit that the present application is in condition for allowance based on the discussion which follows.

As an initial point, it is respectfully submitted that this Amendment after Final should be entered as the amendments to claims 30 and 32-35 make the claim language more commensurable with the arguments of the previously filed responses. Moreover, the amendment to claim 30 more clearly recites that the multi-segmented fluoropolymer comprises a block copolymer and/or a graft copolymer. In addition, claim 32 has been amended to more clearly recite the fluoropolymer segment A is a block copolymer comprising an ethylenic fluoromonomer to be consistent with how the term is used in the Specification and moreover to correct a clear clerical error where “ethylenic fluoropolymer” should have read “ethylenic fluoromonomer”.

Furthermore, the amendment to the claims do not raise new issues for consideration and no additional prior art search needs to be conducted as any previous prior art search would have covered the subject matter now recited in the amended claims. This is in accordance with MPEP § 900 which states, in part, that the prior art search should be conducted by the Examiner after obtaining a thorough understanding of the invention disclosed and claimed including the inventive concept towards which the claims appear to be directed. The features now recited in independent claim 30 and now amended dependent claims were disclosed in the application as filed. Therefore, in accordance with the provisions of MPEP § 900, all elements of the currently pending

claims have been searched and considered and thus the amendment does not raise new issues for consideration. Finally, it is respectfully submitted that the amendment to the claims places the application in proper condition for allowance, serves in providing a complete application file history, enhances the clarity of the prosecution record and places the claims in better condition for appeal. Therefore, entrance of the Amendment after Final is proper.

Turning now to the subject of the Office Action, claims 32-34 were rejected under 35 U.S.C. § 112, second paragraph as being indefinite. In order to more clearly recite Applicants' invention, and in order to correct a previous clerical error, by this Amendment, Applicants have amended claims 32-34 to more clearly recite the fluoropolymer segment A by replacing the term "(a) ethylenic fluoropolymer unit" with the term "an ethylenic fluoromonomer". The amendment to the claims make the claims consistent with the Specification in which "unit" is used to mean "repeating unit". Therefore, both monomer unit and fluoromonomer includes the term "unit" and consequently, the use of both monomer unit and fluoromonomer is redundant.

In addition, the amendment to the claims further clarify that "segment A" and "segment B" mean one block or one graph consisting of a polymer unit as shown in Figure 1 of the present Specificaiton. Further, by this Amendment, Applicants have clarified that the term "multi-segmented polymer" is used to include both a block copolymer and a graph copolymer as is disclosed in the Specification. Finally, the claim amendments clarify that the segment A contains a plurality of sulfonic acid functional groups. This is in contrast to one monomer (e.g. ethylenic fluoromonomer) which

contains one sulfonic acid functional group. Based on the foregoing, Applicants respectfully submit that the claim amendments obviate the rejections under § 112.

Claims 30, 32-36 and 38-40 were rejected under 35 U.S.C. § 102(e) as being anticipated by Cisar U.S. Patent No. 6,492,431 (hereinafter “Cisar”). The Examiner alleges that Cisar teaches a material comprising a multi-segmented fluoropolymer that comprises a block copolymer containing at least two types of fluoropolymer chain segments.

As noted above with regard to the § 112 rejections, by this Amendment, Applicants have amended to claims to more clearly recite Applicants’ invention which further distinguishes the present invention from Cisar. Cisar fails to teach or suggest a block copolymer as claimed. Although Cisar uses the term “block” when describing its composition, Cisar fails to teach or suggest a block copolymer.

Further, although the Examiner alleges that Cisar teaches block copolymers (Response to Arguments Section of the Office Action, on page 7, alleging that Cisar clearly states that the membrane may be blended as well as altering blocks of each type of segment described), the alternating blocks of Cisar do not mean a block of a block copolymer but the “blocks” refer to each polymer of a composite membrane comprising blended polymers.

Moreover, not only is Cisar silent with regard to a block copolymer or a graph copolymer, Cisar merely discloses nafion, which is a random copolymer. Therefore, the present invention, directed to a multi-segmented fluoropolymer is not anticipated by or made obvious in view of Cisar.

Based on the foregoing, Cisar fails to teach or suggest a block copolymer and therefore fails to teach or suggest the multi-segmented fluoropolymer claimed. According, Applicants respectfully request the rejections to claims 30, 32-36 and 38-40 as being rejected under 35 U.S.C. § 102(e) be withdrawn.

In view of the foregoing, Applicants respectfully submit that the present application is in condition for allowance.

END REMARKS

ATTACHMENT B
Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application.

1. (Withdrawn) A material for a solid polyelectrolyte; said material comprising:
a multi-segmented fluoropolymer having a fluoropolymer chain segment A containing sulfonic acid functional groups, which is a copolymer comprising:
 - (a) an ethylenic fluoromonomer unit containing sulfonic acid functional groups represented by Formula (1)
$$CX_2=CX^1-(O)_n-Rf-SO_2Y \quad (1)$$
wherein X and X¹ may be the same or different and are each hydrogen or fluorine; Y is F, Cl or OY¹ wherein Y¹ is hydrogen, alkali metal or C₁ to C₅ alkyl; Rf is C₁ to C₄₀ divalent fluoroalkylene or C₁ to C₄₀ divalent fluoroalkylene having ether bond(s); and n is 0 or 1; and
 - (b) at least one type of ethylenic fluoromonomer unit copolymerizable with the unit (a) and containing no sulfonic acid functional groups;

and a fluoropolymer chain segment B containing no sulfonic acid functional groups, the fluoropolymer chain segment B having a crystalline melting point of 100°C or higher or a glass transition point of 100°C or higher.

2-4. (Canceled)

5. (Withdrawn) The material according to claim 1, wherein the at least one type of ethylenic fluoromonomer unit (b) containing no sulfonic acid functional groups comprises tetrafluoroethylene.

6. (Withdrawn) The material according to claim 1, wherein the fluoropolymer chain segment B is a polymer chain comprising 85 to 100 mol% of tetrafluoroethylene and 15 to 0 mol% of a monomer represented by Formula (3)



wherein Rf^a is CF₃ or ORf^b and Rf^b is C₁ to C₅ perfluoroalkyl.

7. (Withdrawn) The material according to claim 1, wherein the multi-segmented fluoropolymer has an equivalent weight of 400 to 1600.

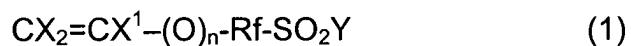
8. (Withdrawn) The material according to Claim 1, comprising a multi-segmented fluoropolymer having at least two types of fluoropolymer chain segments C and D containing sulfonic acid functional groups, the fluoropolymer chain segment C having a smaller equivalent weight than the fluoropolymer chain segment D.

9. (Withdrawn) The material according to Claim 8, wherein the fluoropolymer chain segment D has a crystalline melting point of 100°C or higher or a glass transition point of 100°C or higher.

10. (Withdrawn) The material according to Claim 8, wherein the fluoropolymer chain segments C and D containing sulfonic acid functional groups are each a copolymer comprising:

- (c) an ethylenic fluoromonomer unit containing sulfonic acid function groups; and
- (d) at least one type of ethylenic fluoromonomer unit copolymerizable with the unit (c) and containing no sulfonic acid functional groups.

11. (Withdrawn) The material according to claim 10, wherein the ethylenic fluoromonomer unit (c) containing sulfonic acid functional groups is represented by Formula (1)



wherein X and X¹ may be the same or different and are each hydrogen or fluorine; Y is F, Cl or OY¹ wherein Y¹ is hydrogen, alkali metal or C₁ to C₅ alkyl; Rf is C₁ to C₄₀ divalent fluoroalkylene or C₁ to C₄₀ divalent fluoroalkylene having ether bond(s); and n is 0 or 1.

12. (Withdrawn) The material according to Claim 8, comprising the multi-segmented fluoropolymer in which the fluoropolymer chain segment D has an equivalent weight of 1000 or more.

13. (Withdrawn) The material according to Claim 8, wherein the multi-segmented fluoropolymer has an equivalent weight of 400 to 1600.

14. (Withdrawn) A solid polyelectrolyte membrane comprising the multi-segmented fluoropolymer according to claim 1.

15. (Withdrawn) The solid polyelectrolyte membrane according to Claim 14, wherein the multi-segmented fluoropolymer contains protonated sulfonic acid (SO_3H) groups as the sulfonic acid functional groups, and has a modulus of elasticity of at least 1×10^8 dyn/cm² at 110°C or higher.

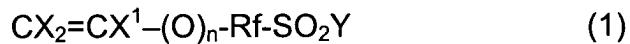
16. (Withdrawn) The solid polyelectrolyte membrane according to Claim 15, wherein the equivalent weight of the whole multi-segmented fluoropolymer is 1600 or less.

17. (Withdrawn) A multi-segmented fluoropolymer having a fluoropolymer chain segment A¹ containing sulfonic acid functional groups and a fluoropolymer chain segment B¹ containing no sulfonic acid functional groups, wherein:

the fluoropolymer chain segment A¹ containing sulfonic acid functional groups is a copolymer having a molecular weight of 5000 to 750000 and comprising:

(e) 1 to 50 mol% of at least one type of structural unit represented by Formula

(1)



wherein X and X¹ may be the same or different and are each hydrogen or fluorine; Y is F, Cl and OY¹ wherein Y¹ is hydrogen, alkali metal or C₁ to C₅ alkyl; Rf is C₁ to C₄₀ divalent fluoroalkylene or C₁ to C₄₀ divalent fluoroalkylene having ether bond(s); and n is 0 or 1, and

(f) 99 to 50 mol% of at least one type of ethylenic monomer structural unit containing no sulfonic acid functional groups; and

the fluoropolymer chain segment B¹ is a fluoropolymer chain containing at least one type of ethylenic fluoromonomer unit and having a molecular weight of 3000 to 12000000.

18. (Withdrawn) The multi-segmented fluoropolymer according to claim 17, wherein the ethylenic fluoromonomer (e) in the fluoropolymer chain segment A¹ is represented by Formula (2)



wherein Y is F, Cl or OY¹ wherein Y¹ is hydrogen, alkali metal or C₁ to C₅ alkyl; Rf is C₁ to C₄₀ divalent fluoroalkylene or C₁ to C₄₀ divalent fluoroalkylene or C₁ to C₄₀ divalent fluoroalkylene having ether bond(s).

19. (Withdrawn) The multi-segmented fluoropolymer according to Claim 17, wherein the ethylenic monomer (f) in the fluoropolymer chain segment A¹ contains at least one ethylenic fluoromonomer.

20. (Withdrawn) The multi-segmented fluoropolymer according to Claim 19, wherein the ethylenic monomer (f) is tetrafluoroethylene.

21. (Withdrawn) The multi-segmented fluoropolymer according to Claim 17, wherein the fluoropolymer chain segment B¹ is a polymer chain comprising 85 to 100 mol% of tetrafluoroethylene and 15 to 0 mol% of a monomer represented by Formula (3)

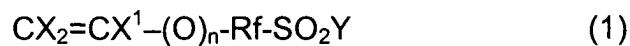


wherein Rf^a is CF₃ or ORf^b and Rf^b is C₁ to C₅ perfluoroalkyl.

22. (Withdrawn) A multi-segmented fluoropolymer having at least two types of fluoropolymer chain segments C¹ and D¹ containing sulfonic acid functional groups, wherein:

the fluoropolymer chain segment C¹ is a copolymer having a molecular weight of 5000 to 750000 and comprising:

(g) 13 to 50 mol% of at least one type of ethylenic fluoromonomer structural unit containing sulfonic acid functional groups and represented in Formula (1)

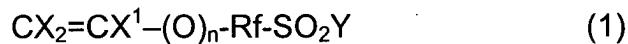


wherein X and X¹ may be the same or different and are each hydrogen or fluorine; Y is F, Cl or OY¹ wherein Y¹ is hydrogen, alkali metal or C₁ to C₅ alkyl; Rf is C₁ to C₄₀ divalent fluoroalkylene or C₁ to C₄₀ divalent fluoroalkylene having ether bond(s); and n is 0 or 1, and

(h) 87 to 50 mol% of at least one type of ethylenic monomer structural unit containing no sulfonic acid functional groups; and

the fluoropolymer chain segment D¹ is a fluoropolymer chain having a molecular weight of 3000 to 1200000 and comprising:

(i) not less than 0.1 mol% but less than 13 mol% of at least one type of ethylenic fluoromonomer unit containing sulfonic acid functional groups and represented by Formula (1)



wherein X, X¹, Y, n and Rf are as defined above, and

(j) more than 87 mol% but not more than 99.9 mol% of at least one type of ethylenic monomer unit containing no sulfonic acid functional groups.

23. (Withdrawn) The multi-segmented fluoropolymer according to claim 22, wherein the ethylenic fluoromonomer (g) in the fluoropolymer chain segment C¹ is represented by Formula (2)



wherein Y is F, Cl or OY¹ wherein Y¹ is hydrogen, alkali metal or C₁ to C₅ alkyl; Rf is C₁ to C₄₀ divalent fluoroalkylene or C₁ to C₄₀ divalent fluoroalkylene having ether bond(s).

24. (Withdrawn) The multi-segmented fluoropolymer according to Claim 22, wherein the ethylenic monomer (h) in the fluoropolymer chain segment C¹ contains at least one ethylenic fluoromonomer.

25. (Withdrawn) The multi-segmented fluoropolymer according to Claim 24, wherein the ethylenic monomer (h) in the fluoropolymer chain segment C¹ is tetrafluoroethylene.

26. (Withdrawn) The multi-segmented fluoropolymer according to claim 22, wherein the ethylenic fluoromonomer (i) in the fluoropolymer chain segment D¹ is represented by Formula (2)



wherein Y is F, Cl or OY¹ wherein Y¹ is hydrogen, alkali metal or C₁ to C₅ alkyl; Rf is C₁ to C₄₀ divalent fluoroalkylene or C₁ to C₄₀ divalent fluoroalkylene having ether bond(s).

27. (Withdrawn) The multi-segmented fluoropolymer according to Claim 22, wherein the ethylenic monomer (j) in the fluoropolymer chain segment D¹ contains at least one ethylenic fluoromonomer.

28. (Withdrawn) The multi-segmented fluoropolymer according to Claim 27, wherein the ethylenic monomer (j) in the fluoropolymer chain segment D¹ is tetrafluoroethylene.

29. (Withdrawn) A solid polyelectrolyte membrane comprising the multi-segmented fluoropolymer according to claim 8.

30. (Currently Amended) A material for a solid polyelectrolyte, comprising a multi-segmented fluoropolymer that comprises a block copolymer and/or a graph copolymer containing:

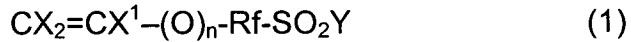
_____ (i) one or more ~~fluoropolymer chain~~-segment A containing sulfonic acid functional groups and a
_____ (ii) one or more ~~fluoropolymer chain~~-segment B containing no sulfonic acid functional groups,
_____ the fluoropolymer ~~chain~~-segment B having a crystalline melting point of 100°C or higher or a glass transition point of 100°C or higher.

31. (Canceled)

32. (Currently Amended) The material according to claim 30, wherein the fluoropolymer ~~chain~~-segment A containing sulfonic acid functional groups is a block copolymer or a graph copolymer comprising:

(a) an ethylenic ~~fluoropolymer unit~~ fluoromonomer containing sulfonic acid functional groups; and
(b) at least one type of ethylenic fluoromonomer ~~unit~~ copolymerizable with the ~~unit~~ fluoromonomer (a) and containing no sulfonic acid functional groups.

33. (Currently Amended) The material according to claim 32, wherein the ethylenic fluoromonomer unit (a) containing sulfonic acid functional groups is represented by Formula (1)



wherein X and X¹ may be the same or different and are each hydrogen or fluorine; Y is F, Cl or OY¹ wherein Y¹ is hydrogen, alkali metal or C₁ to C₅ alkyl; Rf is C₁ to C₄₀ divalent fluoroalkylene or C₁ to C₄₀ divalent fluoroalkylene having ether bond(s); and n is 0 or 1.

34. (Currently Amended) The material according to claim 32, wherein the at least one type of ethylenic fluoromonomer unit (b) containing no sulfonic acid functional groups is tetrafluoroethylene.

35. (Currently Amended) The material according to claim 30, wherein the fluoropolymer chain segment B is a polymer chain comprising 85 to 100 mol% of tetrafluoroethylene and 15 to 0 mol% of a monomer represented by Formula (3)



wherein Rf^a is CF₃ or ORf^b wherein Rf^b is C₁ to C₅ perfluoroalkyl.

36. (Previously Presented) The material according to claim 30, wherein the multi-segmented fluoropolymer has an equivalent weight of 400 to 1600.

37. (Withdrawn) The material according to claim 8, which comprises a multi-segmented fluoropolymer having a block copolymer of at least two types of fluoropolymer chain segments C and D containing sulfonic acid functional groups, the fluoropolymer chain segment C having a smaller equivalent weight than the fluoropolymer chain segment D.

38. (Previously Presented) A solid polyelectrolyte membrane comprising the multi-segmented fluoropolymer according to claim 30.

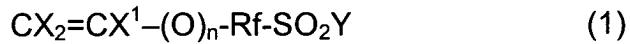
39. (Previously Presented) The solid polyelectrolyte membrane according to claim 38, wherein the multi-segmented fluoropolymer contains protonated sulfonic acid (SO_3H) groups as the sulfonic acid functional groups, and has a modulus of elasticity of at least 1×10^8 dyn/cm² at 110°C or higher.

40. (Previously Presented) The solid polyelectrolyte membrane according to claim 39, wherein the equivalent weight of the whole multi-segmented fluoropolymer is 1600 or less.

41. (Withdrawn) The multi-segmented fluoropolymer according to claim 17, which has a block copolymer of a fluoropolymer chain segment A¹ containing sulfonic acid functional groups and a fluoropolymer chain segment B¹ containing no sulfonic acid functional groups, wherein:

the fluoropolymer chain segment A¹ containing sulfonic acid functional groups is a copolymer having a molecular weight of 5000 to 750000 and comprising:

(e) 1 to 50 mol% of at least one type of structural unit represented by Formula (1)



wherein X and X¹ may be the same or different and are each hydrogen or fluorine; Y is F, Cl or OY¹ wherein Y¹ is hydrogen, alkali metal or C₁ to C₅ alkyl; Rf is C₁ to C₄₀ divalent fluoroalkylene or C₁ to C₄₀ divalent fluoroalkylene having ether bond(s); and n is 0 or 1, and,

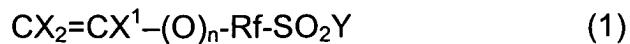
(f) 99 to 50 mol% of at least one type of ethylenic monomer structural unit containing no sulfonic acid functional groups; and

the fluoropolymer chain segment B¹ is a fluoropolymer chain containing at least one type of ethylenic fluoromonomer unit and having a molecular weight of 3000 to 1200000.

42. (Withdrawn) The multi-segmented fluoropolymer according to claim 22, which has a block copolymer of at least two types of fluoropolymer chain segments C¹ and D¹ containing sulfonic acid functional groups, wherein:

the fluoropolymer chain segment C¹ is a copolymer having a molecular weight of 5000 to 750000 and comprising:

(g) 13 to 50 mol% of at least one type of ethylenic fluoromonomer structural unit containing sulfonic acid functional groups and represented by Formula (1)

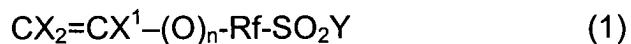


wherein X and X¹ may be the same or different and are each hydrogen or fluorine; Y is F, Cl or OY¹ wherein Y¹ is hydrogen, alkali metal or C₁ to C₄₀ divalent fluoroalkylene having ether bond(s); and n is 0 or 1, and

(h) 87 to 50 mol% of at least one type of ethylenic monomer structural unit containing no sulfonic acid functional groups; and

the fluoropolymer chain segment D¹ is a fluoropolymer chain having a molecular weight of 3000 to 1200000 and comprising:

(i) not less than 0.1 mol% but less than 13 mol% of at least one type of ethylenic fluoromonomer unit containing sulfonic acid functional groups and represented by Formula (a)



wherein X, X¹, Y, n and Rf are as defined above, and

(j) more than 87 mol% but not more than 99.9 mol% of at least one type of ethylenic monomer unit containing no sulfonic acid functional groups.

43. (Withdrawn) The solid polyelectrolyte membrane according to claim 29, wherein the multi-segments fluoropolymer contains protonated sulfonic acid (SO₃H) groups as the sulfonic acid functional groups, and has a modulus of elasticity of at least 1X10⁸ dyn/cm² at 110°C or higher.

44. (Withdrawn) The solid polyelectrolyte membrane according to claim 43, wherein the equivalent weight of the whole multi-segmented fluoropolymer is 1600 or less.